The ABCs of Radon for Kansas Schools

Radon in Schools

The United States Environmental Protection Agency (EPA) and Center For Disease Control (CDC) have sent out warnings of an increased risk of lung cancer associated with exposure to elevated levels of radon in homes. Recently, schools in Kansas and other states have also been tested for radon, and rooms with elevated concentrations have been found. In fact, in a preliminary study of 16 states, the EPA found that over half the schools tested had at least one classroom with radon screening measurements that exceeded EPA guidelines.

Because indoor radon concentrations vary with building construction, ventilation characteristics, and the underlying soil and rock, the only way to determine if a particular school has elevated radon concentrations is to test it. As a result, an increasing number of schools throughout the country are initiating their own radon measurement programs.

Radon Facts

Radon-222 is a colorless, odorless, tasteless, radioactive gas that occurs naturally in soil, rocks, underground water, and air. It is produced by the natural breakdown (radioactive decay) of radium-226 in soil and rocks. The radon gas breaks down to radon decay products that can attach themselves to particles in the air. Humans breathing radon decay products have an increased chance of developing lung cancer. Radon is the second leading cause of lung cancer in the United States.

In outdoor air, radon is usually present at such low levels that there is very little risk. When radon enters a building, however, it and its decay products can accumulate to high concentrations. The Surgeon General's office of the US Public Health Service and the EPA recognize that indoor radon constitutes a substantial health risk, and they have publicly advised that most homes be tested. EPA also is encouraging the testing of other structures, such as schools and work places. The EPA and CDC rank indoor radon among the most serious environmental problems facing us today.

Radon Effects on the General Population

The association between exposure to elevated radon concentrations and increased risk of lung cancer depends not only upon the concentration of radon but also on the length of time a person is exposed. In general, risk increases as the level of radon, the length of exposure, and an individual's smoking habits increase. Estimates of health risks associated with radon are based on lifetime exposure.

Not everyone who breathes radon decay products will develop lung cancer, and-for those that do--the time between exposure and the appearance of cancer may be many years. Lung cancer generally does not appear until a person is at least 35 years of age; in most cases lung cancer is discovered between the ages of 45 and 85.

The EPA and other scientific groups estimate that about 20,000 lung cancer deaths each year may be due to exposure to radon and its decay products. In 1987, there were about 138,000 lung cancer deaths in the United States; EPA estimates that about 15 percent may have been related to radon exposure.

Although radon exposure may cause lung cancer, smoking is still clearly the major cause. Many lung cancers may be caused by the combined effect of radon exposure and smoking. In fact, the National Academy of Sciences estimates that exposure to radon decay and tobacco smoke in combination may be as much as ten times as serious as exposure to either pollutant by itself.

Radon Effects on Children

There is currently limited data on how radon exposure affects children. Consequently, it is difficult to ascertain whether the risks from radon exposure are higher or lower for children than for adults.

Most of the data relating lung cancer to radiation exposure during childhood comes from studies on Japanese, atomic bomb survivors. These data suggest that children may be more susceptible than adults to cancers induced by radiation. However, sufficient time has not yet elapsed since the atomic bomb exposures to determine if the higher rate of lung cancer development in the exposed children will persist.

Until more data becomes available, it is prudent to assume that children are at higher risk from exposure to radon than are adults for two reasons. First, children have smaller lung volumes and higher breathing rates, which may result in higher radiation doses to children from a given radon concentration. Second, based upon data currently available, it appears that the probability that a specific dose of radiation will induce cancer may

decrease with age.

Radon Exposure in Schools

Schools may be a significant source of radon exposure for children and staff. However, because occupancy patterns in schools differ from those in homes, the actual exposures received by each individual, or even by the entire school population, are difficult to determine. Children, teachers and other school employees may spend most of their time in one room or may visit several classrooms each day. Each of these rooms may have different average radon concentrations.

Until more information is available, studies assume that each person remains in one school room for six to eight hours a day. This approach provides a margin of safety, since it probably overstates exposure if the rooms with the highest readings are used to assess the maximum health risk due to exposure at school. This does not mean that a radon problem in school should be taken lightly.

Keith Geiger, National Education Association President, has stated, "All students have the right to expect a safe and healthy school environment. Teachers and other school employees should encourage their schools to conduct radon tests and undertake all necessary corrective actions. The health of our children demands no less."

Radon Entry into Schools

Schools vary in their construction, heating, ventilation, air conditioning (HVAC), and occupancy patterns. The EPA has collected information through various studies including a study on the school system in Fairfax County, Virginia. It has used these data to learn how variables can affect radon concentrations and has considered this information in the development of interim reports. The EPA has documented several observations.

First, the EPA has observed that schools, unlike houses, may be built on several adjoining slabs. The joints between these slabs may offer entry points for radon.

Second, investigating whether a HVAC system is designed and operated properly is an important part of understanding radon problems in schools. Sometimes schools were not designed with adequate ventilation. In other instances, ventilation systems were not operated properly for reasons such as increased energy cost or uncomfortable drafts. Schools may have one or more complex HVAC system. HVAC systems in the schools surveyed to date include central air handling systems, room-sized unit ventilators, and radiant heat. The unit ventilators and radiant heat can exist with or without a separate ventilation system. Central air handling systems and unit ventilators were most prevalent in the schools visited and are used in most newer, air conditioned schools.

Depending on the type of HVAC system in a school, operation of the system may produce positive or negative pressure conditions. Positive pressure within a school decreases the potential for radon entry, while negative pressure within a school increases the potential for radon entry.

When a HVAC system is operating normally, at a reduced rate, or completely shut down, there can be an increase or decrease of radon concentrations depending on the type of ventilation system and the construction of the school. Even though elevated radon concentrations may exist when the system is off, there is a possibility that the elevated concentrations may dissipate when the system is on.

On the other hand, a school may have a ventilation system that creates a negative pressure situation while operating. In this case, there is a greater potential for radon entry when the system is on.

Lastly, school occupancy patterns can have a varying effect on radon concentrations. Unlike homes, schools are usually closed on weekends and overnight. The HVAC system is often turned down during these periods. This could have an affect on the radon concentrations and result in measurements that are not representative of radon concentrations to which children and school employees are exposed.

Additional findings from research in schools points to the facts that radon concentrations in schools typically vary from room to room, and schools in the same general area can have significantly different radon concentrations. It is important to note that radon concentrations vary significantly over time. Changes in ventilation, occupancy patterns, weather conditions, and other variables may cause maximum and minimum screening concentrations in a room to vary by as much as a factor of ten or more. Average concentrations may vary by a factor of two to three. The variability found in schools may be higher than that found in houses. In addition, radon concentrations are considerably higher in basement and first floor rooms than on upperlevel floors.

Testing Schools for Radon

Screening Test Result	**Action**
Over 20 pCi/L	School officials should take confirmatory measurements which last two days to four weeks. If screening measurement is above 100 pCi/L, school officials may wish to relocate.
	School officials should take 9 to 12 month confirmatory measurements.
4pCi/L to 20 pCi/L	School officials should decide whether confirmatory measurements are necessary.
Less than 4pCi/L	

Testing for radon is simple. The EPA has published and issued guides to schools throughout the country. Basically, this is the testing procedure:

1. All frequently used rooms on and below the ground level should be tested.
2. Tests should be conducted in the cooler months of the year.
3. Screening tests lasting for two days to three months should be conducted to determine a school's potential for having a radon problem.
4. Schools should conduct confirmatory measurements if screening levels indicate a potential radon problem (greater than 4pCi/L).
5. Schools should take action to reduce levels if confirmatory measurements are greater than 4 pCi/L.

Correcting Elevated Levels of Radon

Fortunately, if your school has elevated radon levels, the problem can be corrected simply and economically. Proven techniques are available that will lower radon levels-and lower children's risk of ever developing lung cancer from radon in their lifetime. Am Lynch, National PTA President, has stated, "When environmental hazards such as radon endanger the healthful environment of a school, parents must become involved to ensure that the buildings are safe. Radon in schools poses a real danger, but fortunately one that can be addressed quickly and at relatively low cost. To ignore the problem would be a serious mistake."

The most serious consequence of high radon levels is that our children may be exposed to a risk equivalent of smoking half a pack of cigarettes or more a day. Obviously, the higher the radon level, the greater the risk is of developing lung cancer. As a result of these findings, EPA Administrator, William Reilly, recommends that schools nationwide be tested for radon.

Information Available for Schools

The Kansas Department of Health and Environment's Radiation Control Program has many radon publications available free upon request. Program staff are available to give presentations on radon and its health risk to interested parties. Publications on radon in schools that are available through the Radiation Control Program are:

✏ Radon in Schools,

- Radon Measurements in Schools - Self Paced Training Workbook,
- Radon Prevention in the Design and Construction of Schools and Other Large Buildings, and
- Radon Redaction Techniques in Schools - Interim Technical Guidance.
- Learning About Radon - a part of nature

For more information contact:

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